

IN THE CLAIMS

1. (Currently Amended) A thermal processing roller which includes a heat transfer medium flowing path therein and heats a member to be processed abutting against a surface of the roller or absorbs heat therefrom by a heat transfer fluid flowing through the heat transfer medium flowing path,

wherein a sealed chamber extending extends in a longitudinal direction of the roller and in which a heat transfer medium of vapor liquid two phases having a vapor phase and a liquid phase is sealed, the chamber being formed within a thick portion of the roller.

2. (Original) A thermal processing roller according to claim 1, further comprising an electromagnetic induction heating mechanism.

3. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 1, comprising:

heat transfer fluid supply unit for supplying heat transfer fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat transfer fluid supplied from the heat transfer fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat transfer fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature different from the first setting temperature to control a temperature of the heat transfer fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined range, whilst changes into the first temperature control unit when the difference exceeds the predetermined range.

4. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 2, comprising:

heat transfer fluid supply unit for supplying heat transfer fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat transfer fluid supplied from the heat transfer fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat transfer fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature different from the first setting temperature to control a temperature of the heat transfer fluid to the second setting temperature; and switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined range, whilst changes into the first temperature control unit when the difference exceeds the predetermined range.

5. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 1, comprising:

heated transfer fluid supply unit for supplying heated transfer fluid to the thermal processing roller;
a first temperature sensor for detecting a temperature of the heated transfer fluid supplied from the heated transfer fluid supply unit;
first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heated transfer fluid to the first setting temperature;
a second temperature sensor for detecting a surface temperature of the thermal processing roller;
second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature lower than the first setting temperature to control a temperature of the heated transfer fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control unit when the difference exceeds the predetermined value.

6. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 2, comprising:

heated transfer fluid supply unit for supplying heated transfer fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heated transfer fluid supplied from the heated transfer fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heated transfer fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature lower than the first setting temperature to control a temperature of the heated transfer fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control

unit when the difference exceeds the predetermined value.

7. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 1, comprising:

heat absorbing fluid supply unit for supplying heat absorbing fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat absorbing fluid supplied from the heat absorbing fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat absorbing fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature higher than the first setting temperature to control a temperature of the heat absorbing fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control unit when the difference exceeds the predetermined value.

8. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 2, comprising:

heat absorbing fluid supply unit for supplying heat absorbing fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat absorbing fluid supplied from the heat absorbing fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat absorbing fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature higher than the first setting temperature to control a temperature of the heat absorbing fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control unit when the difference exceeds the predetermined value.

9. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 3, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

10. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 5, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.
11. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 7, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.
12. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 4, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.
13. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 6, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.
14. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 8, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

15. (Currently Amended) A thermal processing roller which includes a heat transfer medium flowing path therein and heats a member to be processed abutting against a surface of the roller or absorbs heat therefrom by a heat transfer fluid flowing through the heat transfer medium flowing path,

wherein a plurality of sealed chambers each extending extend in a longitudinal direction of the roller and in each of which a heat transfer medium of vapor liquid two phases having a vapor phase and a liquid phase is sealed, each chamber being are formed within a thick portion of the roller along an outer peripheral surface of the roller, tubes respectively penetrating within the sealed chambers in a longitudinal direction thereof are provided, and the tubes are used as the heat transfer medium flowing path.

16. (Original) A thermal processing roller according to claim 15, further comprising an electromagnetic induction heating mechanism.

17. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 15, comprising:

heat transfer fluid supply unit for supplying heat transfer fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat transfer fluid supplied from the heat transfer fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat transfer fluid to the first setting temperature;
a second temperature sensor for detecting a surface temperature of the thermal processing roller;
second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature different from the first setting temperature to control a temperature of the heat transfer fluid to the second setting temperature; and switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined range, whilst changes into the first temperature control unit when the difference exceeds the predetermined range.

18. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 16, comprising:

heat transfer fluid supply unit for supplying heat transfer fluid to the thermal processing roller;
a first temperature sensor for detecting a temperature of the heat transfer fluid supplied from the heat transfer fluid supply unit;
first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat transfer fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature different from the first setting temperature to control a temperature of the heat transfer fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined range, whilst changes into the first temperature control unit when the difference exceeds the predetermined range.

19. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 15, comprising:

heated transfer fluid supply unit for supplying heated transfer fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heated transfer fluid supplied from the heated transfer fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heated transfer fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature lower than the first setting temperature to control a temperature of the heated transfer fluid to the second setting temperature; and switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control unit when the difference exceeds the predetermined value.

20. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 16, comprising:

heated transfer fluid supply unit for supplying heated transfer fluid to the thermal processing roller;
a first temperature sensor for detecting a temperature of the heated transfer fluid supplied from the heated transfer fluid supply unit;
first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heated transfer fluid to the first setting temperature;
a second temperature sensor for detecting a surface temperature of the thermal processing roller;
second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature lower than the first setting temperature to control a temperature of the heated transfer fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control unit when the difference exceeds the predetermined value.

21. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 15, comprising:

heat absorbing fluid supply unit for supplying heat absorbing fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat absorbing fluid supplied from the heat absorbing fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat absorbing fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature higher than the first setting temperature to control a temperature of the heat absorbing fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control

unit when the difference exceeds the predetermined value.

22. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 16, comprising:

heat absorbing fluid supply unit for supplying heat absorbing fluid to the thermal processing roller;

a first temperature sensor for detecting a temperature of the heat absorbing fluid supplied from the heat absorbing fluid supply unit;

first temperature control unit for comparing a temperature detected by the first temperature sensor with a first setting temperature to control a temperature of the heat absorbing fluid to the first setting temperature;

a second temperature sensor for detecting a surface temperature of the thermal processing roller;

second temperature control unit for comparing a temperature detected by the second temperature sensor with a second setting temperature higher than the first setting temperature to control a temperature of the heat absorbing fluid to the second setting temperature; and

switching unit for changing into the second temperature control unit when a difference between the temperature detected by the second temperature sensor and the second setting temperature is within a predetermined value, whilst changes into the first temperature control unit when the difference exceeds the predetermined value.

23. (Withdrawn) A temperature control apparatus for the thermal processing roller according

to claim 17, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

24. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 19, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

25. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 21, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

26. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 18, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

27. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 20, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

28. (Withdrawn) A temperature control apparatus for the thermal processing roller according to claim 22, wherein the second temperature sensor for detecting a surface temperature of the thermal processing roller is inserted into a thick portion near a surface of the roller.

29. (New) The thermal processing roller according to claim 1, wherein the heat transfer fluid is flowed from outside of the roller to the heat transfer medium flowing path.
30. (New) The thermal processing roller according to claim 1, wherein the heat transfer fluid comprises oil.
31. (New) The thermal processing roller according to claim 1, wherein the heat transfer medium comprises water.
32. (New) The thermal processing roller according to claim 15, wherein the heat transfer fluid is flowed from an outside of the roller to the heat transfer medium flowing path.
33. (New) The thermal processing roller according to claim 15, wherein the heat transfer fluid comprises oil.
34. (New) The thermal processing roller according to claim 15, wherein the heat transfer medium comprises water.
35. (New) A thermal processing roller comprising:
a roll shell;

a heat transfer medium flowing path for flowing a heat transfer fluid flowed from outside of the roll shell; and

a sealed chamber formed in the roll shell, wherein a heat transfer medium having a vapor phase and a liquid phase is sealed in the sealed chamber.

36. (New) The thermal processing roller according to claim 35, wherein the heat transfer medium flowing path penetrates within the sealed chamber.

37. (New) The thermal processing roller according to claim 35, further comprising an electromagnetic induction heating mechanism.

38. (New) The thermal processing roller according to claim 35, wherein the heat transfer fluid comprises oil.

39. (New) The thermal processing roller according to claim 35, wherein the heat transfer medium comprises water.